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**Notes:**

1. Untranslatable words are replaced with asterisks (\*\*\*\*).
2. Texts in the figures are not translated and shown as it is.

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## FULL CONTENTS

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### [Claim(s)]

[Claim 1] The blue light-emitting diode 1 is optically connected to at least one place of the end face of the transparent light guide plate 2. Furthermore, have the scattering layer 3 by which white powder was applied to either of the principal surfaces of said light guide plate 2, and [ the principal surface side of the light guide plate 2 by the side of said scattering layer 3 and opposite ] The source of sheet-like light characterized by the fluorescent substance which the transparent film 6 is formed, is excited by luminescence of said blue light-emitting diode 1 the surface or inside the film 6, and emits fluorescence possessing.

[Claim 2] The source of sheet-like light according to claim 1 characterized by giving detailed unevenness to the surface which touches the light guide plate of the above-mentioned film.

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### [Detailed Description of the Invention]

#### [0001]

[Industrial Application] This invention relates to the source of sheet-like light which starts the light source of the shape of a field used for the backlight of a display, an illumination type operation switch, etc., especially can be conveniently used as backlight of a liquid crystal display.

#### [0002]

[Description of the Prior Art] EL and a cold cathode pipe are used for the source of sheet-like light for the backlight of the liquid crystal display generally used for a notebook computer, a word processor, etc., for example. Itself of EL is a source of sheet-like light, a cold cathode pipe is made into the source of sheet-like light using a diffusion board, and the luminescence color of those backlight is made white [ most ] now.

[0003] On the other hand, the light emitting diode (it is described as Following LED.) is also used in part as a light source for backlight. However, by the former, when obtaining white luminescence using LED, since there is only an about tens of microwatts luminescence output of blue LED, in order to realize white luminescence using other Red LED and Green LED, there is a fault that color change is large that it is hard

to make the characteristic of each [ these ] color luminescence LED agree. Moreover, since those LED(s) were checked by looking as backlight in the near position even if it gathers trichromatic LED and arranges geometrically on the same plane in the same position, it was impossible to have made it a uniform white light source. Therefore, in the white source of sheet-like light of liquid crystal backlight, if large-sized, the present condition is properly used with EL, and most backlight of white luminescence using LED is not known by a cold cathode pipe, small size - the medium size now.

[0004] Moreover, although the trial which surrounds the circumference of a blue LED chip by resin containing a fluorescent substance, and carries out color conversion also occurs partly as a light source of white luminescence or monochrome, since the chip circumference is exposed to the light of radiant intensity stronger than sunlight, degradation of a fluorescent substance poses a problem, especially it is remarkable at an organic fluorescent pigment. Furthermore, the organic dyestuff of ionicity may start electrophoresis by direct-current \*\*\*\* near the chip, and a color tone may change. Moreover, the conventional blue LED was not a thing usable even if it does not have sufficient output to carry out color conversion but carries out color conversion with a fluorescent substance.

[0005]

[Problem to be solved by the invention] [ the place which accomplished in order that this invention might solve such a fault, and is made into the purpose ] While realizing the source of sheet-like light which can be used mainly as backlight and for which light can be emitted white using LED It is in offering the source of sheet-like light which can observe uniform white luminescence, and is in offering the source of sheet-like light which can emit light for arbitrary colors other than white further, using the characteristic of LED excellent in reliability, and using for various operation switches etc.

[0006]

[Means for solving problem] The blue light-emitting diode 1 is optically connected to at least one place of the end face of the light guide plate 2 with a transparent source of sheet-like light of this invention. Furthermore, the scattering layer 3 by which white powder was applied to either of the principal surfaces of said light guide plate 2 (-- the principal surface by the side of a scattering layer is hereafter called second principal surface.) - [ it has and / the principal surface (henceforth first principal surface) side of the light guide plate 2 by the side of said scattering layer 3 and opposite ] It is characterized by the fluorescent substance which the transparent film 6 is installed, is excited by luminescence of said blue light-emitting diode 1 the surface or inside the film 6, and emits fluorescence possessing.

[0007] Drawing 1 is the top view which looked at the light guide plate 2 of the source of sheet-like light of this invention from the second principal surface side. A light guide plate 2 consists of transparent material, such as acrylics and glass, and a light guide plate 2 and the blue LED 1 are optically connected by laying the blue LED 1 under the end face of the light guide plate 2. in addition, [ connect / the blue LED 1 and the end face of a light guide plate 2 / optically ] in this invention Not to mention laying the blue LED 1 underground, as it says introducing the light of blue LED from the end face of a light guide plate 2, for example, is shown in this figure, if it says simply It is realizable by pasting up blue LED and leading luminescence of blue LED to the

end face of a light guide plate 2 using an optical fiber etc.

[0008] Next, the scattering layer 3 is scattering light in a light guide plate 2 with the white pigment. So that said scattering layer 3 may especially be made into the shape of a stripe by drawing 1 and the surface luminosity by the side of the first principal surface may become fixed. It is considered as a pattern which reduces the area of the scattering layer 3 per unit area by the side of the second principal surface, and area of the end of LED1 and the second most distant principal surface is further made small a little as compared with the maximum area as LED1 is approached. Here, \*\* in drawing 1 expresses the pattern of the scattering layer 3. Although blue LED is made into the structure allotted to one end face six pieces in drawing 1, if a light guide plate is a quadrangle, to say nothing of connecting LED, the number of LED will not be limited to all end faces on all sides. Furthermore, luminescence observed from the first principal surface side according to the arrangement situation of LED -- the shape of a field -- the application form of a scattering layer 3 and an application state can be suitably changed so that it may suppose that it is uniform.

[0009]

[Function] Drawing 2 is a \*\* type sectional view at the time of mounting the source of sheet-like light of this invention as backlight of a liquid crystal panel. The dispersion reflecting layer 7 which is on a second [ of the source of sheet-like light which this shows to drawing 1 ] principal surface side, for example from barium titanate, titanium oxide, an aluminum oxide, etc., For example, the light reflector by which the base 8 which consists of aluminum was laminated is installed, the transparent film 6 with which detailed unevenness was given is installed in the surface at the first principal surface side, and the fluorescent substance which is excited by luminescence of the blue LED 1 on the surface where unevenness of this film 6 was given, and emits fluorescence is applied.

[0010] As the arrow of drawing 2 shows first, the light which came out of the blue LED 1 is emitted to the exteriors other than light guide plate 2 in part near the chip, but a great portion of light reaches the end face of a light guide plate 2 in the inside of a light guide plate 2, repeating total internal reflection. It is reflected by the reflective film 4 formed in all end faces, and the light which reached the end face repeats total internal reflection. At this time, light is scattered about by the scattering layer 3 prepared in the second [ of a light guide plate 2 ] principal surface side, wavelength conversion is carried out simultaneously, it is emitted [ a part of scattered light is absorbed by the fluorescence layer 5, ], and the luminescence color observed from the first [ of a light guide plate 2 ] principal surface side can observe the light which compounded such light. For example, in the source of sheet-like light in which the fluorescence layer 5 which consists of an orange fluorescent pigment was formed, by the operation described previously, the luminescence color from the blue LED 1 becomes white, and it can observe.

[0011] At this invention, the main luminescence peak of especially the luminescence wavelength of one blue LED is shorter than 500nm, and the luminescence output needs 200 microwatts or more of outputs of 300 microwatts or more still more preferably. It is because it is in the tendency for the light source of field-like luminescence with sufficient uniform brightness to be hard to be obtained even if it increases the number of blue LED which connects with the end face of a light guide plate optically even if when it becomes it difficult

to realize all the colors that a luminescence wavelength is 500nm or more and there are few the luminescence outputs than 200 microwatts.

[0012] Moreover, this invention person is Tokuganhei5-318267 and proposed the source of sheet-like light in which uniform white luminescence is possible by forming a fluorescence scattering layer in the luminescence view plane and principal surface side of the light guide plate by the side of opposite. However, by this method, in the obtained source of sheet-like light, the fluorescence scattering layer formed in the light guide plate for changing a color tone had to be removed, and a fluorescence scattering layer which serves as the target color tone again had to be printed. However, in this invention, the fluorescence layer 5 and a scattering layer 3 become independent, respectively, and since the fluorescence layer 5 which determines especially a color tone is formed on the removable film, a color tone can be simply changed only by changing the film with which the fluorescence layer 5 was formed. Moreover, division luminescence of two or more colors can be carried out simultaneously.

[0013] And since unevenness is given to the surface which touches the first [ of a film 6 ] principal surface side, it is very useful for scattering the light which emitted light, and can prevent a film's 6 sticking to a light guide plate 2, and making interference fringes.

[0014]

[Working example]

[Work example 1] The scattering layer 3 was formed in one side of an acrylics board about 2mm thick by screen-stencil by the pattern of the shape of a stripe shown in drawing 1 . The scattering layer 3 printed and formed what distributed the white substance which consists of barium titanate in the acrylic binder.

[0015] After cutting the acrylics board with which the scattering layer 3 was formed as mentioned above according to the desired pattern and grinding all the end faces (cutting plane) of an acrylics board, the light guide plate 2 with which the scattering layer 3 was formed was obtained by forming the reflecting layer 4 which becomes a polished surface from aluminum.

[0016] Next, the fluorescence layer 5 was formed in the film 6 with which detailed unevenness was given to the surface. The fluorescence layer 5 applied and formed what distributed the fluorescent pigment which mixed ana product FAmade from SHINROIHI chemistry-001 which are a red fluorescent pigment, and company FA-005 which are a green fluorescent pigment in the acrylic binder.

[0017] Six places and a hole were established in the end face of said light guide plate 2, and it embedded at a time one blue LED 1 which consists of a luminescence wavelength of 480nm, and a gallium nitride system compound semiconductor which has 1200 microwatts of luminescence outputs in the hole, respectively. then, the place which installed the light reflector by which the film 6 with which the fluorescence layer 5 was formed as mentioned above was applied to the barium titanate layer 7 on the aluminum base 8 at the scattering layer 3 side in the luminescence view plane side, and was made into the light source for backlight -- from the first principal surface side -- perfect -- the shape of a field -- uniform white luminescence was obtained. Luminosity was 55cd/m<sup>2</sup>.

[0018] [Work example 2] It is LumogenF of BASF A.G. as yellow fluorescence dye. Company Orange-240

are mostly mixed in equivalent amount as Yellow-083 and orange fluorescence dye. The fluorescence dye which dissolved them and an acrylic resin in butyl rib TORU acetate was applied on the film 6 with which it was given to detailed unevenness. Except it, when the source of sheet-like light of this invention was obtained like the work example 1, almost uniform field-like luminescence was observed. Furthermore, when it was similarly considered as the light source for backlight, completely uniform field-like luminescence was observed.

[0019]

[Effect of the Invention] As explained above, moreover, the source of sheet-like light of this invention has the scattering layer 3 to which white powder was applied in one principal surface side of a light guide plate using blue LED. Furthermore, by installing the transparent film 6 with which the fluorescent substance which can carry out wavelength conversion by blue LED was applied to another principal surface side, it became possible to realize the source of sheet-like light by LED excellent in reliability. And since the white powder of a scattering layer 3 has the operation which reflects and diffuses luminescence of blue LED, there is little amount of the fluorescent substance used to be used, and it ends. Furthermore, by forming detailed unevenness in a film 6, it can prevent raising the operation which scatters light, and a film's sticking to a light guide plate 2, and making interference fringes. Furthermore, since a LED chip and a fluorescent substance do not meet with a convenient thing directly, there is little degradation of a fluorescent substance and it does not cause color tone change of the source of sheet-like light over a long period of time. Moreover, since arbitrary color tones including white can be offered and the fluorescent substance is provided on the film according to the kind of fluorescent substance of the fluorescence layer 5 about the color tone, the color tone of the source of sheet-like light can be simply changed only by changing a film.

[0020] When the luminescence output of the blue LED most preferably used as a side which excites the fluorescence layer 5 on the other hand considers it as a thing of 200 microwatts or more, wavelength conversion is efficiently carried out with a fluorescent substance, and the source of sheet-like light where a big area is bright can be realized. Thus, the source of sheet-like light of this invention is also applicable to the illumination type operation switch using a fluorescent substance etc. not only as a light source for backlight.

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[Brief Description of the Drawings]

[Drawing 1] The top view which looked at the light guide plate 2 of the source of sheet-like light of one work example of this invention from the scattering layer 3 side.

[Drawing 2] The \*\* type sectional view at the time of mounting the source of sheet-like light of one work example of this invention as backlight.

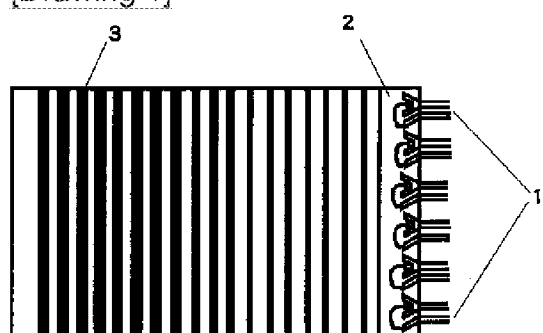
[Explanations of letters or numerals]

1 ..... Blue LED

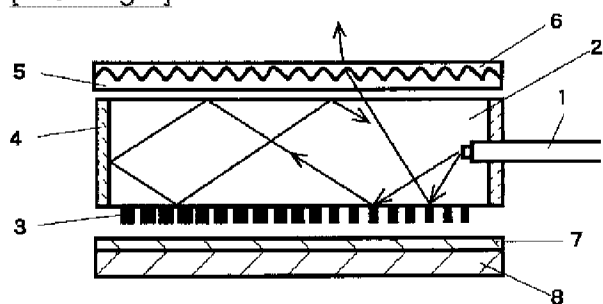
2 ..... Light guide plate

- 3 ..... Scattering layer
  - 4 ..... Reflecting layer
  - 5 ..... Fluorescence layer
  - 6 ..... Film
  - 7 ..... Dispersion reflecting layer
  - 8 ..... aluminum base
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[Drawing 1]



[Drawing 2]



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[Translation done.]